POWERGEN

INDIANAPOLIS, IN, GE TURBINE HVOF

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Case Study

SYNOPSIS

A GE Turbine system and Main Lube Oil Tank (MLOT) needed a thorough cleaning and contaminate removal to improve bearing life and protect the turbines critical parts. A lube oil flush, side-stream filtration, mechanical pipe cleaning, and varnish removal process performed by RIG achieved an ISO particle count better than 15/14/10.

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INTRODUCTION

RIG was contracted to perform a high velocity hot oil flush of the General Electric turbine at a Power Plant in Indianapolis, IN. RIG technicians arrived onsite on 12/12/17, completed site specific safety training, and conducted a safety walk down of the work area.

A Job Safety Analysis (JSA) was completed prior to starting. Equipment was offloaded and staging was started. All RIG high flow filtration skids, filter carts, and hoses arrived to the job site hydrotested, checked for functionality, and free of contamination.

STAGE 1: SETUP

Equipment was offloaded and staged in designated area. The bearing jumpers were installed on the inboard and outboard side of the generator. Piping connected to the turbine inboard and outboard bearings was removed for manual mechanical cleaning. All instrumentation lines were disconnected and capped to prevent migration of contamination into those lines. The accumulator lines were isolated to prevent flow to the removed accumulator.

The reservoir was drained upon arrival and a reservoir cleaning was conducted prior to flushing. RIG's 350gpm high flow filtration skid was connected to the onboard pump discharge line inside the reservoir. To supply RIG flush unit a "stinger" was attached to the supply line and inserted into manway. Allowing RIG's skid to draw oil from the main lube oil tank (MLOT).

Figure 1. Jumper Setup

Figure 2. Suction and Discharge-Lines to Flush Skid

STAGE 2: FLUSH

RIG started circulation with flushing skid. Oil was pulled from the main lube oil tank (MLOT) through a 350gpm positive displacement pump into two 16kw heaters at a 17,303 Reynolds number. The target temperature for the flush was 150 degrees Fahrenheit. From the heaters the oil was pumped through three 1um beta 1000 microglass filters. Flow continued into the system via the outlet point of the removed onboard pump discharge line.

Note: There was no inline filtration on this unit. Flow continued through the heat exchanger, bearing supply lines, custom jumpers with valves, and back into the MLOT through the return header.

Once circulation was achieved a leak check was performed system wide. The leak check passed and circulation was continued for a 33-hour course flush to remove the bulk of contamination.

The onboard lube oil system utilized a side stream filtration unit including filtration and coalescing elements. This skid was cleaned and filters were replaced.

Approximately 220 gallons of the provided 605 gallons was used in the system during flushing. The remaining 385 gallons was transferred into an external reservoir provided by RIG for side stream filtration. A 40gpm filter cart with a 1um beta 1000 micro-glass filter was utilized for this operation. The oil was filtered until an ISO particle count of better than 15/14/10 was reached and was put back into 55-gallon drums for future use.

STAGE 3: INSPECTIONS

At the conclusion of the course flush inspection screens were installed for a one-hour run. The initial screens revealed a large amount of contamination remained in the system. Screens were reinstalled at 24-hour intervals until the screens passed API 614 visual cleanliness standards. The final verification screens were approved by the customer at 3:45pm on 12/19/17.

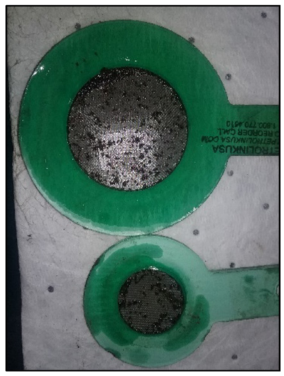

Figure 3. Jumper Setup

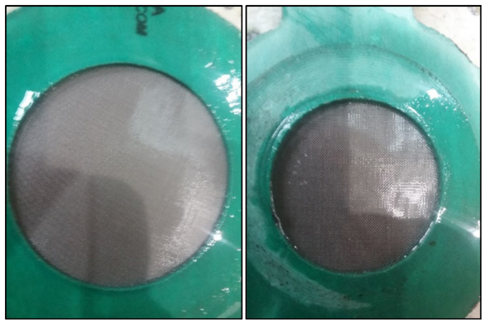

Figure 4. Final Verification Screens

STAGE 4: RESERVOIR CLEANING/ REINSTATEMENT

After verification of system cleanliness the RIG supply, discharge lines, and jumper materials were removed. The mechanically cleaned piping was reinstalled. Foreign material exclusion practices were used on all openings open to the atmosphere.

The MLOT was cleaned but was not final filled with lube oil. This was due to future work needing to be performed to the onboard lube oil pump by a contractor.

Filters, waste oil, and oily rags were properly disposed of onsite. RIG equipment was removed from site and housekeeping was conducted in the work area.

Figure 5. MLOT Before Cleaning

Figure 6. MLOT After Cleaning

Figure 7. Before Cleaning

Figure 8. After Cleaning

RECOMMENDATIONS

Due to the presence of carbon steel in the system a two-stage chemical clean is recommended before the next high velocity hot oil flush on this system or ones of a similar type/age. The first stage consists of a degreaser to remove hydrocarbon deposits bonded to the inside of the piping. The second stage consists of a rust removing agent. The agent is non-hazardous to work with and is environmentally friendly.

The main lube oil tank (MLOT) has several areas that can be repaired or covered to prevent ingress of contamination. With the lack of inline filtration, it is essential to keep the MLOT as free of contamination as possible. With this, a replacement of the traditional breather with a desiccant type breather prevents ingression of both contamination and water.

The MLOT had evidence of condensation, a desiccant type breather will mitigate this condition. Quarterly filtration of the Lube Oil reservoir with side stream filtration will help keep system within OEM specifications.

Many of the bearing supply lines on the lube oil system are copper in construction. The inside of the copper tubing has deteriorated and copper was evident on the rags used during the mechanical hand cleaning of the removed tubing. Bends in the tubing have created uneven surfaces that have encouraged contamination build up. In the third-party lab results elemental spectroscopy section copper is reading 9ppm. Replacement of this tubing and carbon steel piping with stainless steel could extend bearing life.

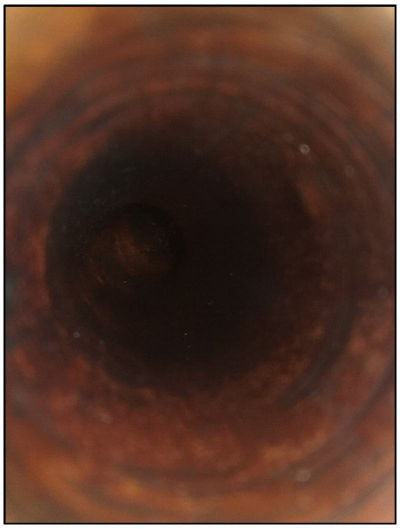

Figure 9. Copper Tubing

Figure 10. Evidence of Condensation in MLOT

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